CLAIMS

1. Apparatus for remote gas sensing comprising a light source, a photodetector, a gas cell containing gas or a zone through which the gas passes and through which light from the light source passes and is reflected back to the photodetector, wherein the light source, photodetector and gas cell are connected by a single polarisation preserving optical fibre through which light from the light source passes to the gas cell, which light reflected back from the cell passes back through the optical fibre with a different polarisation to that to the light transmitted by the light source.

2. Apparatus according to claim 1 further comprising means to polarise the returned light exiting the gas so that it re-enters the optical fibre polarised orthogonal to the transmitted light.

3. Apparatus according to either one of claims 1 and 2 further comprising means between the light source and the optical fibre arranged to split the returned light from the transmitted light and direct the returned light to the photodetector.

4. Apparatus according to claim 3 wherein the gas cell or zone includes a mirror positioned so that gas in the gas cell passes between a point at which light enters the gas cell and said mirror, so that said mirror reflects light back through the gas and from the gas cell to the optical fibre.

5. Apparatus according to claim 3 wherein the gas cell or zone comprises a resonant optical cavity.

6. Apparatus according to claim 5 including means arranged to sense the gas via the cavity ring-down time of the gas in the resonant cavity.

7. Apparatus according to any one of claims 1 to 3 wherein the light source and photodetector are positioned remotely to the gas cell or zone.

8. Apparatus for remote gas sensing comprising a light source, a photodetector, a gas cell containing gas or a zone through which the gas passes and through which light from the light source passes and is reflected back to the photodetector, wherein the gas cell or zone is located distantly from the light source and photodetection and is connected to the light source and photodetector by a single polarisation preserving optical fibre through which light from the light source passes to the gas cell or zone, and comprising at the gas cell location a polariser to polarise the returned light exiting the gas cell or zone so that it re-enters the optical fibre polarised orthogonal to the transmitted light and passes back through the optical fibre with a different polarisation to that of the transmitted light, and comprising at the other end of the optical fibre a splitter arranged to split the returned light from the transmitted light and direct the returned light to the photodetector.

9. Apparatus for remote gas sensing comprising a light source, a photodetector, a resonant optical cavity containing gas or a zone through which the gas passes and through which light from the light source passes and is directed to the photodetector, and a single polarisation preserving optical fibre connecting the light source and photodetector and resonant optical cavity, through which light from the light source passes to the resonant optical cavity and through which light reflected back from the optical cavity passes back through the optical fibre with a different polarisation to that of the transmitted light.

10. A method for remote gas sensing utilising a light source, a photodetector and a gas cell or zone containing gas or through which gas passes and through which light from the light source passes and is reflected back to the photodetector, including passing light from the source to the gas cell and back to the photodetector via a single polarisation preserving optical fibre such that the return light passes through the optical fibre with a different polarisation to that of the transmitted light.

11. A method according to claim 10 further comprising polarising the returned light exiting the gas so that it re-enters the optical fibre polarised orthogonal to the transmitted light.

12. A method according to either one of claims 9 and 11 further comprising splitting, between the light source and the optical fibre, the returned light from the transmitted light and directing the returned light to the photodetector.

13. A method according to claim 12 including causing the gases to pass in the gas cell or zone between a mirror and a point at which light enters the gas cell, so that said mirror reflects light back through the gas and from the gas cell to the optical fibre.

14. A method according to claim 12 including causing the gas to pass through a gas cell or zone comprising a resonant optical cavity.

15. A method according to claim 14 including sensing the gas via the cavity ring-down time of the gas in the resonant cavity.

16. A method according to any one of claims 10 to 12 wherein the light source and photodetector are positioned remotely to the gas cell or zone.

17. A method for remote gas sensing utilising a light source, a photodetector and a gas cell or zone containing gas or through which gas passes and through which light from the light source passes and is reflected back to the photodetector, which gas cell or zone is located distantly from the light source and photodetector, the method including passing light from the source to the gas cell and back to the photodetector via a single polarisation preserving optical fibre and polarising the returned light exiting the gas so that it re-enters the optical fibre polarised orthogonal to the transmitted light such that the return light passes through the optical fibre with a different polarisation to that of the transmitted light and, at the photodetector and light source end of the optical fibre, splitting between the light source and the optical fibre the returned light from the transmitted light and directing the returned light to the photodetector.

18. A method for remote gas sensing utilising a light source, a photodetector and a resonant optical cavity containing gas or through which gas passes and through which

light from the light source passes and is reflected back to the photodetector, including passing light from the source to the resonant optical cavity and back to the photodetector via a single polarisation preserving optical fibre such that the return light passes through the optical fibre with a different polarisation to that of the transmitted light.